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End-of-life vehicle regulation in Germany and Europe — problems and perspectives

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Summary

Approximately 9 million end-of-life vehicles (ELVs) are currently being discarded each year in Europe with around 25 percent going to landfill. Several voluntary programmes have already been established by car manufacturers. But hardly any of these meets the recovery percentages proposed by German and European directives. The recent initiatives to change the regulation of ELVs in Europe are marked by different and mainly opposing demands of the various stakeholders concerning the effects of an environment-friendly policy. The main question is how to organize a management shared between regulation by laws and directives and voluntary agreements introduced by the industry.

Since 1998, a modernised infrastructure of receiving stations and recycling plants for ELVs has been established in Germany. Today, this network comprises approximately 1,400 accredited recycling plants and some 15,000 accredited receiving stations to ensure environment-friendly disposal of end-of-life vehicles. In the long run it can be expected that the automobile industry will take the opportunity to organize the whole system of recycling itself. But it is an open question whether central dismantling facilities will minimise costs in the short term and economise profitably in the long term. For this regional networks of certified car dismantling companies which are acting as contract partners of the car industry are an alternative solution. Re-used parts present an opportunity for the dismantling companies to compete directly with new car parts — something that can be realised even better with new Internet approaches and e-commerce activities.

These challenges need a new framework which should be based on two fundamental issues:

- Firstly, a common understanding among the stakeholders facing material flow problems, economic performance and shared burden.
- Secondly, an effective ELV management system ensuring recycling, re-use and recovery for a high standard of quality and at reasonable costs to manufacturers and consumers.

This not only generates a potential for better performance for the dismantling sector, but can in effect be of immense value to the stability of the whole ELV management system.

1 Introduction

For many years the automobile industries have been taking environmental issues into account for the complete life cycle of their products.[1] In all stages of their life time – from design to use and disposal – products affect the environment. A stricter European environmental legislation is only a logical consequence. Another important factor is the growing consciousness of customers and other stakeholders. In their decision whether or not to purchase a product they are to a growing extent influenced by the companies' environmental activities or the products' impact on the environment.

Recycling, recovery and re-use are three important environmental challenges which have to be faced by the automobile industry. In Germany companies from different business sectors began in 1990 a process for establishing (VDA 1990 et al.) environmental or recycling policies in order to reach certain environmental targets (Schenk 1998). They are organised into a network called "ARGE-Altauto".[2] The main task of this group is to fulfil the voluntary agreement on end-of-life vehicles (ELVs) in Germany, which was signed by 16 institutions representing car manufacturers, automotive industries and recycling operators. In 2000 the ELV Directive was passed by the European Parliament. It will become legislation in the Member States during 2001. The directive means in effect that in future the manufacturers themselves will have to take responsibility for disposing and recycling old cars.

With this in mind the objective of this case-study is to improve the understanding of the end-of-life vehicles regulation in Germany and to discuss the challenge of the new European ELV Directive.

This paper focuses on the following topics:

- Central issues of the end-of-life vehicles regulation (Chapter 2)
- Issues and targets of German and European directives (Chapter 3)
- Discussion of stakeholders' arguments (Chapter 4)
- Conclusions, addressing some ideas for a better framework and ELV management (Chapter 5).

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1 Environmental reports from the following enterprises have been researched: Nissan (1998, 1999), DaimlerChrysler (2000), JAMA (1998), Opel (1998), Toyota (1998).

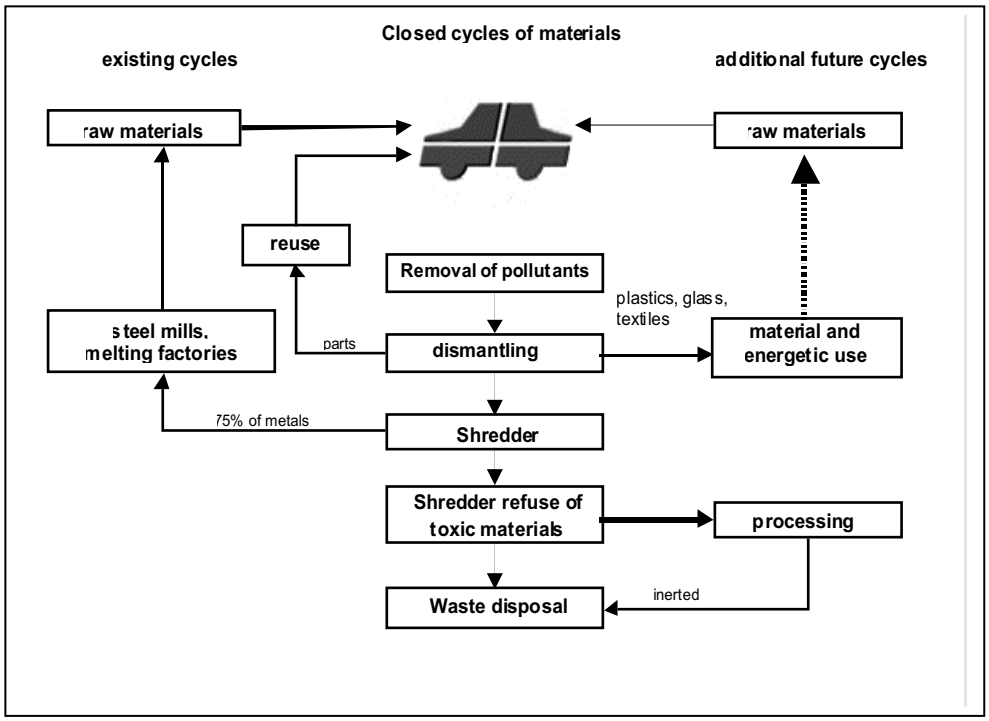
2 www.arge-altauto.de

2 Basic issues

2.1 Changing material proportions in end-of-life vehicles (ELVs)

For decades some 75 percent by weight of an ELV has been recycled. Hardly any other consumer product has a recycling rate as high as the automobile (report of the Enquête Commission "Schutz des Menschen und der Umwelt", p. 303ff). Indeed, entire industries have developed around this task of automobile recycling, currently focusing in particular on the process of returning metallic materials from ELVs to the materials loop. With the objective of achieving a quantitative reduction in the amount of ELV waste, the automotive industry is focusing in particular on those residues which comprise approximately 25 percent of the vehicle's weight and which currently go mainly to landfill sites. This portion of the vehicle is made up more or less equally of inorganic and organic substances (as shown in figure 1).

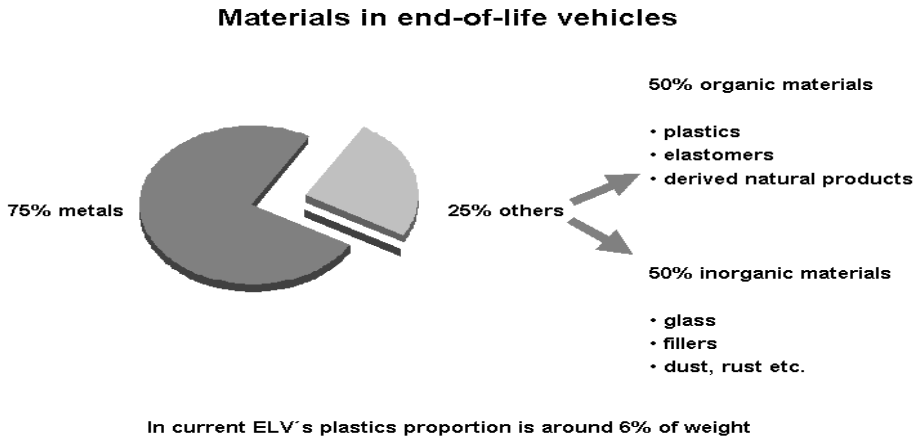
Figure 1: Material flows of ELV



Source: author

The organic substances are mainly polymer materials followed by a small quantity of modified natural substances such as cellulose fibre products or leather. Disproportionate growth in the use of these materials over the last 10 years compared with the metallic part of the car has now focused attention on the plastics part. The proportion of plastic components in motor cars has risen from around 5 percent by weight in 1970 to the present level of around 10 to 12 percent by weight. In vehicles currently reaching the end of their service lives, the proportion is approximately 6 percent.

Figure 2: Materials in end-of-life vehicles



Source: Hook 1998

In actual fact vehicles (passenger cars) consist of approximately 15,000 parts. A common trend in the materials composition of a car is towards an increasing use of light-weight materials, especially towards the use of numerous types of plastics and the use of non-ferrous metals like aluminium, copper and magnesium.

Table 1: Material composition of different vehicle types.

Material	Material Ratio (% by weight)			
	Generic US Vehicle	Generic Japanese Vehicle	Generic EU Compact vehicle	Golf III
Steel and iron	67	72.2	65	64
Plastic	8	10.1	12	16
Glass	2.8	2.8	2.5	3.1
Rubber	4.2	3.1	6	4
Fluids and Lubricants	6	3.4	2.5	5
Non ferrous metal	8	6.2	8	1.6
Electric cable				1.3
Insulation				1.1
Paint				0.9
Other materials	4	2.2	4	3
Total weight (kg)	*1438*	*1270*	*1210*	*1025*

Source: Kuhndt/Bilitewski 2000

The generic European vehicle shows a downward trend in metal content, accounting for about 65 percent of the total weight at the present time. The plastic content of current models has increased fourfold over the last twenty years and it is expected that this will continue to increase to about 15 percent in the next years (Peters 1996). The Golf III has already achieved this level of plastic content.

The activities of dismantlers are very important for achieving a quantitative reduction in the amount of ELV waste: they remove reusable parts and some recyclable materials from the vehicles for resale or recycling before sending what is left – the "hulks" – to the shredders. For a more detailed dismantling practice, information about materials and parts used by the automotive industry is needed. In this matter an International Dismantling Information System (IDIS) has been established.[3] IDIS intends to provide dismantlers with valuable information for an environmentally sound treatment of end-of-life vehicles.

[3] In 1999, the IDIS 2 Consortium grew to now 20 members, representing the interests of BMW AG, Daewoo Motor Corporation, Daihatsu Motor Corporation, DaimlerChrysler AG, Fiat Auto S.p.a, Ford Motor Company, Fuji Heavy Industries Ltd. (Subaru), General Motors, Honda Motor Corporation, Hyundai Motor Corporation, Mazda Motor Corporation, Mitsubishi Motors, Nissan Motor Corporation, PSA Peugeot Citroën, Renault, Rover Group Ltd., Suzuki Motor Corporation, Toyota Motor Corporation, Volkswagen AG and Volvo Car Corporation.

The increasing use of plastics, composite materials and other non-metallic materials (such as ceramics) increases the amount of shredder residue which has to be disposed of. In Germany 550,000 tons of shredder residue are generated every year which largely ends up in municipal landfills or incinerators. Approximately 400,000 tons result from auto salvaging, the remaining 150,000 accumulate from general scrap collections. The shredders rip the hulk into small pieces and recover much of the metal for recycling (Spicer 1996). What is left, known as the automotive shredder residue (ASR), is a low density material consisting of textiles, rubber, glass and plastics. Tests conducted on shredder fluff indicate that the material is predominantly contaminated with PCBs and hydrocarbons, with PCB levels averaging around 50 ppm.

The results of the PRAVDA 2 Project (Hook et al. 1998) show that in certain cases – depending on local conditions, technical, economic and ecological aspects – the mechanical recycling of some plastic parts may be feasible. But the target to reduce effectively the amount of shredder fluff can not be reached only by mechanical and feedstock recycling and energy recovery. A design for recyclability is needed to meet these challenges. In the interests of more efficient recycling, it is also necessary to mark the plastic parts systematically and to reduce the different components generally. To deal with this, since 1995 information about dismantling has been passed on to the recycling industry. A first step in this direction is the "International Dismantling Information System" (IDIS), which was developed at the end of 1999. 20 manufacturers distributed free of charge an IDIS CD-ROM in eight languages to more than 2,500 ELV recyclers all over Europe.[4] This CD-ROM contains dismantling information about 364 different vehicle models and approximately 20,000 different components. Already, the automobile industries are using recycled plastics in the production of new vehicles.

In future this mixed waste has to be recycled or recovered as German environmental policy no longer allows its disposal at landfill sites. The new targets (see Chapter 3.1) for recycling, re-use and recovery are a great challenge for the automobile manufacturers.

2.2 Structural change and new business fields in the dismantling sector

In Germany a modernised infrastructure of receiving stations and recycling plants for end-of-life vehicles has been established since 1998. Today, this network comprises approximately 1,400 accredited recycling plants and some 15,000 accredited receiving stations to ensure environment-friendly disposal of ELVs. A

[4] www.idis2.com

nation-wide infrastructure has also been set up for taking back and recycling end-of-life parts following vehicle repairs. In order to fulfil the requirements of the end-of-life vehicle ordinance and to provide an extensive network for taking back and recycling ELVs, more than DM 0.5 billion has been invested in receiving stations, recycling plants and shredder plants since 1997.

In Germany basic criteria for an environment-friendly disposal of ELVs were laid down in 1998 (see Chapter 3.1). This environmental law had a strong influence on the medium-sized dismantler's sector. A lot of small enterprises were not able to realise the necessary high investments and were forced to quit.[5] Nearly 70 percent of the former 5,000 dismantlers still exist. And the structural change is still going on.

At present, German car manufacturers have already proposed that only around 300 of the 1,400 certified car dismantling companies in Germany will remain as contract partners of the car industry. Moreover Volkswagen, for example, recently hinted that the industry might even move more into the dismantling and shredder industry (Willeke 1999). Thus in the long run it can be expected that the automobile industry will organise the whole system of recycling itself with central dismantling facilities, and will try to minimise costs in the short term and economise profitably in the long term.

A traditional business field of the dismantling operators is the sale of used car parts. In general it can be said that in Continental-Europe, parts recycling, refurbishment and re-use in car repairs is more common, but still not widespread. Whalley (2000) reported that the re-use of used parts from damaged cars traditionally had little application in the United Kingdom car body-repair market aside from the repair of written-off vehicles purchased as being damaged-repairable by body shops or by private individuals from salvage companies. In Sweden, for example, Folksam Auto AB (folksamauto.com) is a subsidiary of the Folksam insurance company which acquired a large car workshop with the aim of speeding up the repair process and of increasing the re-use of used parts to bring down the cost of new original-enterprise (OE) parts. Folksam Auto's operations now include the dismantling of damaged cars and the recycling of used parts for car repairs and there is a well-developed system for the re-use of used parts in body repairs in Sweden.

In May 2000 President Jacques Nasser of the Ford company announced his company's entry into vehicle dismantling in the US, accompanied with a definite 'we may also expand this operation into Europe'. Ford's first site in Tampa will disassemble cars and commercial vehicles for parts, as well as collecting from

[5] In order to fulfil the requirements of the end-of-life vehicle ordinance and to provide an extensive network for taking back and recycling ELVs, more than DM 0.5 billion has been invested at receiving stations, recycling plants and shredder plants since 1997.

other Ford plants for recycling. Ford intends to sell the re-use parts to body shops, insurance companies and directly to the public. Nasser commented, 'We see this as potentially a billion dollar or more business.' Interestingly, the Internet is to feature as the major distribution media to offer "high quality used parts with a quick turnaround to benefit all customers." The move is also thought to tie in with Ford's purchase of Kwik-Fit, Europe's largest independent fast-fit repair chain, which would make a ready avenue for re-use part sales. (Whalley 2000)

These kinds of activities could lead to more competition in the field of re-use and recycling. Smaller dismantlers may disappear from the market and the whole dismantler branch may become ruled by the automobile industry. This could lead to a centralised organisation of distribution and increase the environmental impact due to long-distance logistics.

On the other hand we believe that despite such 'doom & gloom' forecasts small and medium-sized enterprises (SMEs) of the dismantling sector have a great deal to be positive about. Firstly the number of ELVs is still rising, secondly parts re-use is much more environmentally friendly than re-cycling and thirdly there is a great potential for used parts in insurance repair. Recycled parts present an opportunity for dismantling operators to compete directly with pattern parts — something that some manufactures and dismantlers in Germany have already realised and taken advantage of (Lucas 2000).

A regional case study of the Wuppertal Institute (Lucas 2000) shows that there are some new opportunities for regional networking and new services derived by small and medium-sized enterprises (SMEs). A basic field of cooperation is the data-technical networking of differing stocks and their marketing with the help of the Internet. The modernisation of the stock organisation is the central aim of the project "Autoteile per Mausklick", which is supported by the QUATRO programme of the NRW Government (see for further information: www.ersatzteile.net). The system currently only operates with e-mail contact; furthermore an online system will be established allowing the client to research directly for used parts. It seems the Internet and re-use parts will have a linked future.

To push the business with used original parts in body repair, the dismantlers will need to overcome the following obstacles (Whalley 2000):

- Achieving uniform parts quality
- High stocks of low value or unwanted parts
- Establishing a network of authorised vehicle dismantlers
- Establishing a distribution system for used parts

- Gaining customer acceptance of used parts
- Matching parts to model derivatives
- Matching parts condition to vehicle condition
- Lower margins for body shops on used parts than OE parts.

2.3 Reduced input in the national recycling system

The total annual quantity of end-of-life vehicles requiring disposal in Germany during the period 1997 to 1999 has been estimated at between 1.1 and 1.7 million units (ARGE, Monitoring Report 2000). Taking into account the 3.4 million vehicles cancelled from registration every year, it is obvious that a large number of old vehicles are sold to foreign countries. The reason for this is that at the present time the consumer may decide whether he wants to give his car directly to a dismantling facility or to try and find a dealer who will pay a price for the car even if it has a small market value.

In actual fact it can be seen that a lot of car owners prefer to sell their old car than to bring it directly to a dismantling or recycling facility. Furthermore, an increasing number of car dealers resell the old cars to export dealers who transport them to Eastern Europe, Northern Africa and the Middle East. As a result of this, the recycling operators (dismantlers, auto-scrap shredders) are faced with a reduced scale of input and a reduction in the use of their enterprise's capacity. Only approximately 60 percent of the cars which are cancelled from registration in Germany are currently being returned to dismantling and shredding facilities.

3 Targets of the ELV regulation

3.1 The ELV Act in Germany (Altautoverordnung)

After years of discussion in Germany about regulation and responsibility for end-of-life vehicles, on 1 April 1998 the ELV concept finally became law.

Especially the minimum technical requirements were laid down for the disposal of ELVs. The aim was to establish basic standards to be kept by the companies on the utilisation of ELVs. This concerns in particular:

- measures for deconstruction and drainage;
- the removal of specific parts (as advice);
- the inclusion of liquids taken and parts removed in re-use or recycling;
- the inclusion of 15 percent of total weight of an ELV in re-utilisation.

A concrete producer's product responsibility has been renounced. Especially a binding procedure to share the costs has not been established.

3.2 The ELV Voluntary Agreement in Germany (Freiwillige Selbstverpflichtung)

In the 13th legislative period, following a review of the available environmental policy options, voluntary agreements were accepted as being a practical way for realising the producer's responsibility. 16 associations from different sectors including vehicle/passenger car manufacturers, importers, producers and recyclers of parts and raw materials, got together to thrash out the "voluntary agreement regarding the environmentally compatible management of end-of-life vehicles (passenger cars) within the concept of the Ecocycle Act".[6]

This agreement between the government and industrial associations advised the automobile producers to reduce the quantity of harmful materials as a part of

[6] Also, a voluntary vehicle recycling programme has been established by vehicle manufacturers on a European level as a part of the Automotive Consortium on Recycling and Development (ACORD).

waste. Thus the German model for an environmentally friendly restructuring of ELV management comprises voluntary, cooperative measures for the industrial sectors involved, combined with lean regulations in those cases where certain restrictions on freedom of trade are unavoidable.

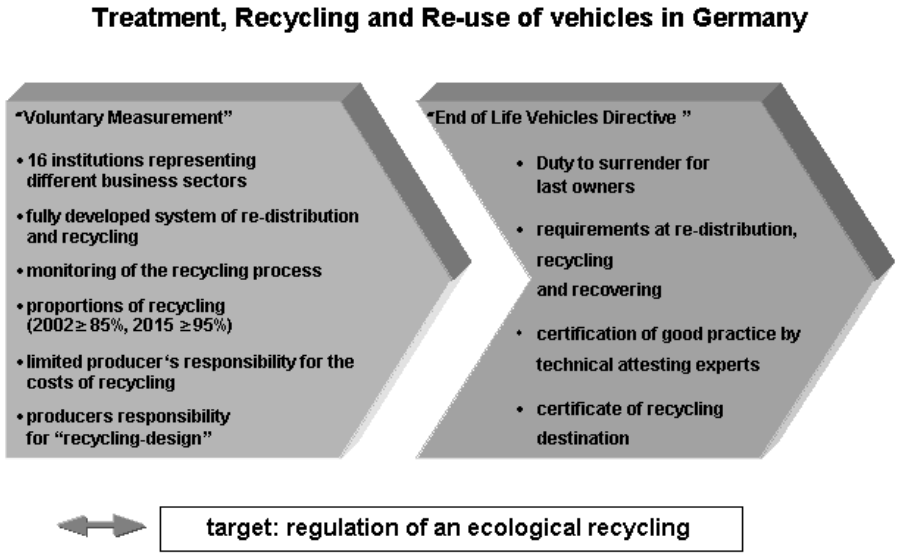
The following targets were laid down:

- Improving recycling capability in construction;
- Development, creation and optimisation of material cycles and re-utilisation possibilities;
- Improvement in the re-utilisation advice given to automobile manufacturers;
- Decrease in the waste from automobile disposal to 15 percent by 2002 and to 5 percent by 2015 on average per automobile producer;
- Qualified assurance of taking back free of charge ELVs not older than 12 years and under certain qualifying conditions;
- Building-up of a monitoring report system to control the devices.

Automobile manufacturers have agreed to take back end-of-life vehicles made by them on the usual market terms and to further improve the capability of their products for recycling. They have also agreed that, subject to certain defined conditions, any vehicle up to twelve years old which was newly registered after the ELV ordinance came into force, will be taken back free of charge from the last owner.

The core of this German model, as summarised in the voluntary agreement, aims at ensuring that end-of-life vehicles are sent to environmentally friendly recycling plants, at reducing the amount of ELV waste sent to landfills and at ensuring more environmentally friendly draining of fluids. The voluntary agreement allows the sectors involved to decide for themselves how they wish to implement their commitment efficiently and economically. To supervise the voluntary agreement, the Arbeitsgemeinschaft Altauto – ARGE (End-of-Life Vehicle Committee) – was formed.

Figure 3: Treatment, recycling and re-use of vehicles in Germany



Source: Fried/Scheucher 2000, translated

3.3 The EU End-of-life Vehicle Directive

Approximately 9 million ELVs are currently discarded each year in Europe with around 25 percent going to landfill. Growing concerns over the environmental impact of vehicles prompted the European Commission to draft legislation in July 1997, regulating the environmentally friendly disposal of end-of-life vehicles (ELVs) for the re-use, recycling and recovery of vehicles and their components. The End-of-life Vehicle (ELV) Directive has been passed by the European Parliament and is now ready for legislation in the Member States (EU 2000).

The directive means that the manufacturers will be faced with the lion's share of the cost of disposing of old cars, with a supplement from national government. It is fixed that a rate of re-use or recovery of 80 percent and a rate of re-use or recycling of 85 percent by weight will be achieved by 2006, and that these percentages should rise to 85 percent and 95 percent respectively in 2015. A main environmental target is to increase the penetration of vehicle recycling through legislation from the present 75 percent of materials recovery achieved on average to 85-95 percent by 2015.

The directive establishes the necessary requirements for collection and treatment facilities to ensure that economic operators set up systems for the collection, treatment and recovery of end-of-life vehicles as follows:

- The last holder and/or owner has to deliver the end-of-life vehicle to an authorised treatment facility (without any cost even if the vehicle has no or a negative market value – as from 1 July 2002 for vehicles put on the market after this date; as from 1 January 2007 for any vehicles on the market.
- Hazardous substances in vehicles should be reduced and controlled to prevent their release into the environment, in particular the use of lead, mercury, cadmium and hexavalent chromium (by 1 July 2003).
- The recycling of all plastics from end-of-life vehicles should be continuously improved; the Commission is currently examining the environmental impacts of PVC.

Article 7

"Member States shall take the necessary measures to encourage the re-use of components which are suitable for re-use, the recovery of components which cannot be re-used and the giving of preference to recycling when environmentally viable, without prejudice to requirements regarding the safety of vehicles and environmental requirements such as air emissions and noise control.

Member States shall take the necessary measures to ensure that the following targets are attained by economic operators:

- no later than 1 January 2006, for all end-of-life vehicles, the re-use and recovery shall be increased to a minimum of 85% by an average weight per vehicle and year; for vehicles produced before January 1980, Member States may lay down targets, but not lower than 75% for re-use and recovery and not lower than 70% for re-use and recycling. Member States making use of this paragraph shall inform the Commission and other Member States of the reasons therefore;
- no later than 1 January 2015, for all end-of-life vehicles, the re-use and recovery shall be increased to a minimum of 95% by an average weight per vehicle and year. Within the same time limit, the re-use and recycling shall be increased to a minimum of 85% by an average weight per vehicle and year."

Source: EU 2000

The major problem of the common position is in our view that the current definition of recycling quotes is entirely weight based. This is essentially not correct, as one kilogram of a specific material will not necessarily result in the same environmental burden as one kilogram of another material. Therefore, environmentally weighed recycling quotes could reflect the burden on the environment in a better way. Current research at the Delft University of Technology in the Netherlands is focusing on redefining recyclability by using weighing material percentages with respect to their environmental impact over the life cycle (Plante 1999; Tempelman 1999).

In its second reading of the proposal on 3 February 2000, the European Parliament corrected the common position specifically with respect to the question of free take-back of vehicles already on the road. Although the Parliament agreed that the last owner of a vehicle should be able to surrender his end-of-life vehicle free of charge, and that the vehicle manufacturer should be either solely or largely responsible for covering the costs of disposing of new vehicles, it did not express an opinion about responsibility for the cost of taking back vehicles already on the road. This would have left it up to the Member States to decide what measures to adopt, in accordance with the principle of subsidiarity.

The EU Directive must be incorporated into national law within 18 months.

3.4 Fund models

At the moment the various ways possible of returning a vehicle without any cost for the last owner are being discussed (Wallau 2000). One is the fund model which is actually being practised successfully in the Netherlands. Three pillars are significant for this kind of fund:

- Pay-in modalities
- Fund management
- Pay-off modalities

The idea is to establish a managed fund which acquires cash from each actor of the automobile sector and distributes the money to the recyclers according to their recycling quantities and activities.

The actors paying can, for example, be the first owner, any of the owners in part or the automobile industry. With this solution the costs can be shifted to the various actors and distributed most effectively. The distribution can be organised

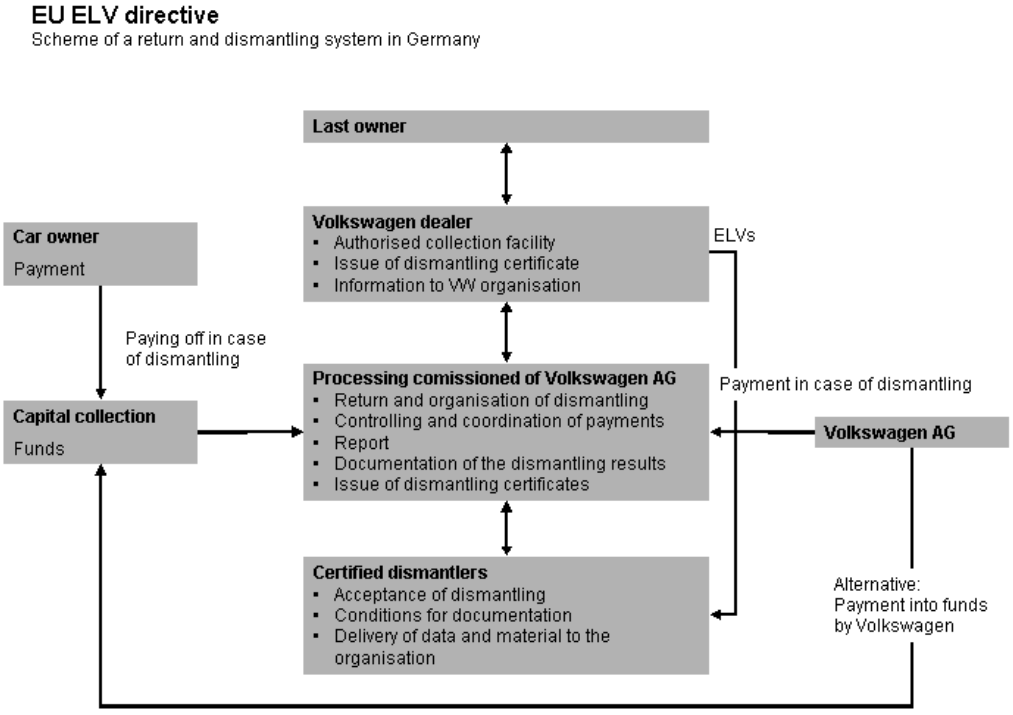
under different aspects. A specific sum for each car is considered as well as a specification according to age, weight, status, etc.

The management can be organised either by one or more automobile producers or completely externally by the government. In any case, the fund's management makes a controlling of the cash flow easy (Wallau 2000).

Recently the Volkswagen AG published their currently favoured model similar to the fund solution (Volkswagen AG 2000). In this model the costs for dismantling will be divided among the producers and car holders. The contribution of the holders will preferably be charged in a lump sum and periodically together with the insurance charges. In the case of a negative market value of the ELV (costs for dismantling are higher than profits from selling parts and materials), the payment of the producer will be reduced. The contribution of the holders should be calculated so that half of the dismantling costs expected will be covered by the holders.

Whether this system is in accordance with the legal advice of the EU ELV directive is questionable.

Figure 4: Outline of a return and dismantling system in Germany

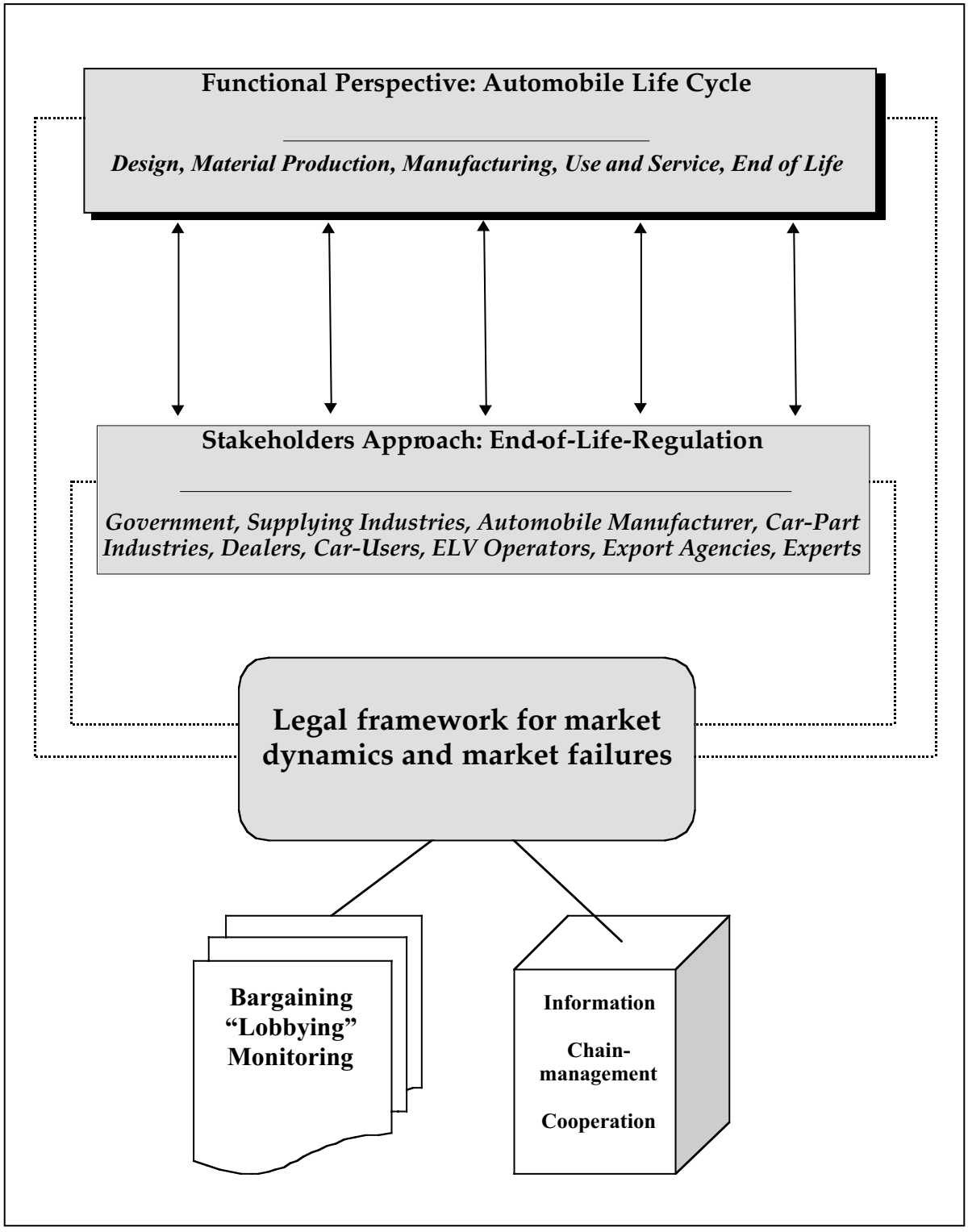


Source: Volkswagen AG, Political News, 2000

4 ELV regulation as seen by various stakeholders

Progressive environmental policy cannot just be based on laws and regulations. Responsible, flexible participation by all the various stakeholders within society is increasingly important. Sustainability is related to the idea that business, consumers and the state are partner-stakeholders in environmental protection. In view of this we would like to give an overview of the stakeholders involved and their actual positions. The stakeholder approach shows that the strategic question – regulation by law or regulation by market – is embedded in a functional and a normative ruling system (Figure 5).

Figure 5: The system of ELV regulation



Source: Author

4.1 Automobile industry (manufacturers, suppliers)

The EU council directive is currently being debated by the automobile manufacturers. Whilst the legislators propose a minimum re-use and recycling percentage of 80 percent by weight per vehicle no later than 1 January 2005, the automobile industry advocates that from a life-cycle environmental perspective the environment will not benefit from following this course of action. The automobile manufacturers criticise especially the directive in terms of recycling quotas, return of ELVs free of charge and exclusion of specific materials.

Recycling quotas, the free return of ELVs and the exclusion of specific materials are rejected by the following arguments (Schäper 2000, VDI-Nachrichten 2000, ACEA 1998).

Recycling quotas:

- The high material recycling ratios stipulated in the EU Directive on end-of-life vehicles intensify the conflict between the objectives of safety, comfort and environmental protection in automotive manufacturing. A high recycling ratio can collide with the motor industry's objective of reducing fuel consumption. Light-weight construction, one way of fulfilling this objective, is significantly hampered by enforced recycling ratios, since the cost of plastic parts and composites would be particularly affected by a high material recycling ratio.
- The use of naturally grown materials will be excluded as they can not be recycled.
- It may not be environmentally sensible to recycle all materials for reuse. Energy recovery can be a substitute for the use of fossil fuels and can be performed in clean state-of-the-art facilities.

Free-of-charge return:

- Delegating the costs for recycling to the automobile industry will take away incentives to efficiently dismantle ELVs and may encourage the exaggeration of costs and neglect efficiency and economy due to the fact that the industry will bear these costs.
- To control the costs of dismantling, car manufacturers would have to take back the vehicles themselves or monitor their partners. The losers might be the small and medium-sized dismantlers.
- The price for new cars would increase as the costs for establishing additional dismantling and recycling facilities would have to be financed.
- Introducing the responsibility for cars already in use is legally questionable.

Exclusion of specific materials:

- Lead is a necessary component of steel and aluminium alloys which are mostly light metals and which therefore contribute to a reduction in fuel consumption and lower emissions.
- Hexavalent chromium serves to improve rust-proofing and helps to produce long-lasting products (ACEA 1998).

4.2 Recycling industry (dismantlers, shredder operators)

In Germany the dismantlers have not built up a strong lobby. Moreover, several dismantlers have clung to the "ARGE-Altauto" committee which is dominated by the automobile manufacturers. A different position of the recycling industry to the above mentioned arguments can therefore hardly be described.

Meanwhile the EFR (European Ferrous Recovery & Recycling Federation) has expressed its concerns about the EU ELV directive and has recently established some basic principles. The first is that certified and fully licensed EFR member companies have developed a highly efficient system for collecting and processing end-of-life vehicles, and that they have both the technology and the know-how to recover and recycle car materials. Another very important precondition for recycling ELVs is that there is a market for recovered materials. The federation rejects a funding system subsidised by the car manufacturer or car purchaser since it will likely lead to market distortion.

The medium-sized companies mainly fear that in being forced to pay for the recycling costs, car manufacturers will be encouraged to control the recycling process totally. This form of producer responsibility would inevitably result in moves to change the existing car dismantling industry with its many small and medium-sized companies.

4.3 German Government, Ministry of Environment

The German Ministry of Environment states that since the German ELV Act and Voluntary Agreement have become law, successes and difficulties can be pointed out. As successes, technical and organisational standards can mainly be named. With these standards many dismantlers have made changes necessary to fulfil the requirements. Meanwhile, some experiences have criticised the implementation of the concept which needs to be changed in the short term. This concerns in particular: assurance of a standardised qualification of the technical experts examining standards and awarding certification; control of the existing declaration

showing the ELV's country of destination in relation to the administrative costs; providing information for the controlling administrators; and, finally, establishing measures for collection and evaluation of information to verify quantification targets of resource flows from automobile recycling.

4.4 Council of experts on environmental questions (SRU – Sachverständigenrat für Umweltfragen)

The "Sachverständigenrat" mainly criticises the deficits concerning the ecological deconstruction and drainage of ELVs, the avoidance of "wild" disposal (dumping or illegal disposal) and effective reporting on the achievement of aims. Deficits in this area can temporarily be solved by a change of product responsibility which would be difficult to manage with different legal instruments. Recent statistics of the Environment Protection Agency (Umweltbundesamt) show that the number of ELVs processed at dismantling facilities has decreased since the beginning of the 90's. Although of course not all the cars cancelled from registration are ELVs and there are no reliable statistics on the destination of these deregistered cars, it can be concluded that the legal system is pervious and suffers from an inconsequent monitoring. To make an effective implementation of the "voluntary agreement" possible, the transparent monitoring of the destination of ELVs should be implemented immediately. Efficient monitoring is the most important element of ensuring the ecological recovery of ELVs.

5 Conclusions

The recent initiatives to change the regulation of ELVs in Europe and in particular Germany are characterised by opposing positions of the various stakeholders on the effects of a more environment-friendly policy. With regard to a material flow approach, it is important to realise that there are frequent conflicts between the reduction of fuel emissions and recycling quotas. No general environmental solution can be derived by following a one-way strategy. Changing only one element of the product or its manufacture may cause detrimental impacts for another. Therefore the improvement strategy of the EU Council has to be evaluated carefully.

Meanwhile there are no clear indications that the approaches being taken actually lead to a more environmentally beneficial product. Light-weight materials, such as polymer composites and aluminium, while reducing the curb weight of the automobile, can also reduce the recyclability of the automobile. And how is vehicle safety maintained, when the vehicle's mass is reduced by 50 percent? Is the reduction of landfill consumption through increased recycling worth the net increase in energy used to run recyclable vehicles? In the absence of a framework for making this determination, progress towards any of these goals will be problematic. These questions cannot be solved by recycling quotas. Rather, it will be necessary for the automobile industry to evaluate the technological alternatives in such a fashion that all three of these criteria are addressed over the entire "life" of the product, including manufacturing, use and disposal.

Another question is how to finance the ELV measures. The automobile producers do not accept complete producer's responsibility for ELVs. Similar to the German "ELV Voluntary Agreement" they want to take back free of charge only a small number of cars, excluding all cars older than 12 years. These cars should only be taken back under common market conditions. The last owner should assume the risks of the low market value and the costs of recycling. All the other, newer cars will follow the market rules anyway.

Contrary to the position of the automotive industries, the common position of the EU definitely strengthens the producer's responsibility for the handling of all ELVs. The directive will force the automobile producers to accept recycling quotas and to exclude toxic materials. This will lead to further costs which will have to be accepted by the millions of car owners when they buy a new car. On the other hand, this measure will enforce eco-innovations in the automobile industry for renewable and recyclable car parts and materials.

Although the proposed legislation is primarily concerned with reducing the environmental impact of vehicles upon society in Germany and Europe, there is also a commercial opportunity from parts recycling for the car manufacturers and the dismantling operators. Key questions for re-use of car parts are customer's acceptance and building a powerful distribution system based on new information links via Internet between suppliers and customers.

On the other hand the opening of Eastern Europe and the different levels of welfare between eastern and southern countries and the so-called "western hemisphere" lead to increasing export rates of used cars. It is obvious that a national regulation system cannot solve this problem. A main challenge is that still the export of products entails export of environmental problems. A solution would be a national law that creates technical standards for the export of ELVs. Furthermore international agreements should be found to support these countries at building up a modified ELV infrastructure.

Summing up, we have to face the fact that the regulation of end-of-life vehicles in Germany and Europe is currently confronted with several problems:

- In 1998 German law and voluntary agreements established new standards for the dismantling and recycling of end-of life vehicles.
- There is no consensus between the various stakeholders which environmental targets and measurements will lead to better environmental results.
- It remains unclear who will bear the costs of a forthcoming European system based on the producer's responsibility.
- In the dismantling and recycling sector a new practice on a higher environmental level has been established. This leads to a structural change, but also to new commercial opportunities.
- An increasing number of old cars are exported by internationally operating car-dealers. Therefore, only a reduced number of old cars are taken in by the modernised recycling infrastructure of Germany.

What entrepreneurs might learn is that the changes in ELV regulation also have consequences for the management culture. To solve the problems shown, a corporate network culture is needed (Meining/Mallad 2000, Fried/Scheucher 2000, Gruden 2000). Corporate culture requires a management based on common goals and rules. Every company/sector in the ELV chain should be given the chance to strive for self-realisation. The newly developed fund system will lead to a new kind of transaction between the automobile industry and the recycling branch. Therefore a common understanding of environmental burden and economic performance has to be established. The system of monitoring should be developed into a system of information about economic, social and ecological

performance. In particular more information is required to create transparency of material flows. It is necessary to deal with this matter in a spirit of partnership whenever problems arise.

Corporate culture in ELV management generates tremendous performance potential if it is no longer understood as a system which is only ruled by the automobile industry. The concept of common responsibility is in the end a call for more partnership and decentralised structures. Such a partnership could lead to better economic performance for the whole industry. And it could also be a cornerstone of stability for the whole ELV management system.

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